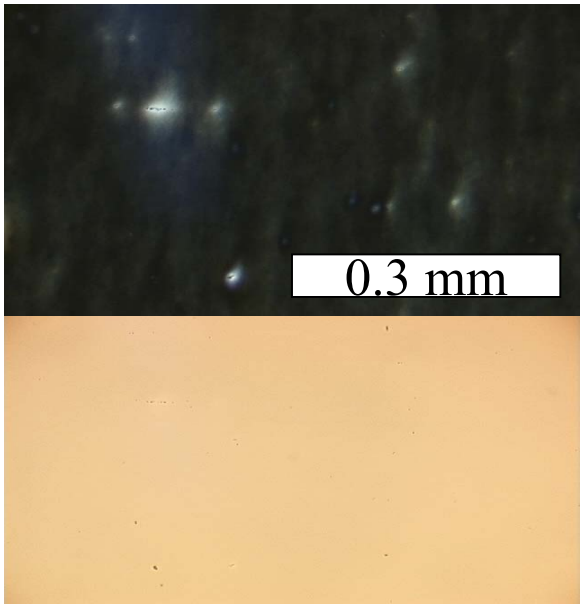
ACT/SGER: Liquid Crystal Materials for Biosensor Development,

Oleg D. Lavrentovich and Christopher J. Woolverton,

Kent State University, DMR-0346348

We develop rapid (minutes) sensors of microbes by combining the liquid crystal (LC) physics and the concept of highly selective antibody-antigen binding. Isolated bacteria, viruses and their antibodies cause no macroscopic distortions of the LC uniformly aligned in a flat cassette. However, once the antibodies find the microbes, they form immune aggregates that distort the LC matrix, causing change in polarized light transmittance, similarly to the principle of the LC displays.



Proof of concept, October 28, 2003:

LC produces optical signal (bright spots, polarized light, top picture) caused by endospore-antibody aggregates from the anthrax simulant, *Bacillus globigii*; non-polarized light and non-LC medium produce no signal (bottom picture).

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Broader impact

The aim is to shorten dramatically the time needed for microbe detection, for example, in the case of anthrax, from few days to few minutes, which is of great importance to national security.

Multidisciplinary collaboration

The project targets the whole new concept of LC-based bio-detection as sketched in the figure; it involves truly multidisciplinary cooperation of graduate students at the Liquid Crystal Institute (Hui Liu) and Department of Biological Sciences (Shannon Miller – Helfinstine), and a specialist in optics, research associate Dr. Yuriy Nastyshyn.